

Order Heterozomata

1937

Body asymmetrical, strongly compressed, precaudal region short. Cranium normal behind, with twisted vertex in front to permit 2 eyes on same side, or one vertical and other lateral. Mouth more or less protractile, formed above on edges by premaxillaries only. Interorbital bar mainly formed by frontal of eyed side. Parietals separated by supraoccipital. Vertebral column of solid centra joined with arches. Pectoral arch joined to skull by forked

also ~~in~~ vertically down or opercle posteriorly. ⁷⁰⁰
T

post-temporal. Upper pharyngeals 4, third largest, much extended forward. Lower pharyngeals separate. Air bladder absent in adult.

Dorsal and anal long. Caudal with 17 rays, 15 branched, or fewer. Ventrals with 6 rays or less, thoracic or jugular.

A large group of fishes, remarkable for the asymmetrical development of color on one side of the body. In the very young both sides of the body are alike, one eye is placed on each side, the cranium normal and the

also preopercle border narrowly and preopercle spine slaty - bluish. Soft vertical fins, interlocking region of tail and caudal peduncle all finely dotted with pale brown, dots not invading dark spots; edges of vertical fins also narrowly bluish; in young pale bluish bars are formed vertically from bases of soft dorsal and anal, over caudal peduncle and caudal base, also vertical fins with fewer and much larger blue spots. Pectoral brown. Ventral dusky brown and with bluish tinge along front edge.

Seychelles, East Indies. The adults or old examples have the soft dorsal and anal fins produced in rather long points, so that both extend backward beyond the end of the tail. Bleeker had but 2 examples 220 to 326 mm. long. In our small examples the head as well as the trunk are often pale in contrast with the rest of the body. Superficially ~~adult~~ coloration, in pattern, is quite suggestive of the American Pomacanthus arcuatus. Our smallest example also shows a narrow gray-white line from occiput to base of preopercle spine and then back to ventral origin, bluish median line in front, 1 from occiput to front eye edge and down over front of cheek, another from end of maxillary to

fish swims erect.

1939

786

Depth $1\frac{1}{2}$ to $1\frac{3}{5}$; head $3\frac{1}{4}$ to $3\frac{3}{4}$, width $1\frac{2}{3}$ to $1\frac{4}{5}$. Snout $2\frac{1}{8}$ to $2\frac{3}{5}$ in head from snout tip; eye $3\frac{1}{5}$ to 5, $1\frac{1}{5}$ to $1\frac{2}{3}$ in snout, $1\frac{1}{4}$ to $1\frac{7}{8}$ in interorbital; maxillary reaches nearly half way in snout, nearly to front nostril, 3 to $3\frac{2}{5}$ in head; interorbital $2\frac{1}{8}$ to $3\frac{4}{5}$, broadly convex; preopercle spine along inner edge $2\frac{1}{2}$ to $4\frac{1}{5}$. Gill rakers 5 + 13, very short, small points, about $\frac{1}{7}$ of gill filaments, which slightly longer than eye.

Scales 70 to 75 counted close along and above lateral line to caudal base; tubular scales about 50 to 56; 13 scales above lateral line, 33 or 34 below. Scales with 3 to 8 basal radiating striae; apical denticles 25 to 45, each with long slender root; circuli fine.

D. XIII, 21, I or 22, I, last spine $1\frac{1}{4}$ to 2 in total head length, seventh ray $2\frac{1}{5}$ to $2\frac{7}{8}$ in combined head and body; A. III, 19, I or 20, I, third spine $1\frac{1}{5}$ to $2\frac{1}{8}$ in head, fifth ray $2\frac{1}{4}$ to $2\frac{3}{4}$ in combined head and body; least depth of caudal peduncle 2 to $2\frac{1}{5}$ in head; caudal convex behind, $1\frac{1}{8}$ to $1\frac{1}{3}$; pectoral 1 to $1\frac{1}{10}$; ventral $2\frac{1}{3}$ to $3\frac{2}{5}$ in combined head and body.

Largely uniform brown, though median area slightly paler. On trunk and tail most of larger scales each with large dark slaty or bluish spot. Dors brown. Border of gill-cover narrowly

Analysis of Families

a.¹ Dorsal not extending forward on head, front rays spinous; eyes on right or left side; each ventral with spine and 5 soft rays. Psettodidae.

a.² Dorsal extending forward on ~~breast~~ head at least until over eye, none of rays spinous; ventral without spine.

b.¹ Preopercle edge free; lower jaw usually prominent.

c.¹ Eyes on left side (except in reversed specimens). Bothidae.

c.² Eyes on right side (except in reversed specimens). Pleuronectidae.

b.² Preopercle edge not free, hidden by skin and scales of head; lower jaw never prominent.

d.¹ Eyes on right side. Soleidae.

d.² Eyes on left side. Gynoglossidae.

Crossorhombus dimorphus (Gilchrist)

Platophrys dimorphus Gilchrist,
Marine Investig. South Africa, vol. 3,
p. 10, pl. 27, 1905 (type locality: $2\frac{1}{2}$
miles off Umhlanga River mouth,
 Natal, 22 to 26 fathoms). — Gilchrist
and Thompson, Ann. Durban Mus.,
vol. 1, pt. 4, p. 400, May 21, 1917 (reference).

Crossorhombus dimorphus Regan, Ann.
Durban Mus., vol. 2, pt. 5, p. 212 (Natal).
— Barnard, Ann. South African
Mus., vol. 22, pt. 1, p. 386, June 1925
(Natal, Zululand, Delagoa Bay, 3
to 30 fathoms).

Platophrys grandisquama (not Schlegel)
Gilchrist, Marine Investig. South Africa,
vol. 4, p. 161, 1906.

Family Psettodidae

1941

Elongately ovoid, strongly compressed. Head moderate. Upper eye little advanced, on upper profile of head. Maxillary with well developed supramaxillary. Mouth large, lower jaw prominent. Teeth strong, pointed, equally developed in both sides of jaws. Palatines with teeth. Nasal openings on blind side scarcely higher than those of other side. Olfactory laminae transverse to radiating from central rachis. Preopercle edge free. No gill rakers. Vertebral 24, of which 14 caudal. Scales rather small. Dorsal not extended forward on head, front rays feeble

Hepatus lineolatus (Valenciennes).

Acanthurus lineolatus Valenciennes, Hist.

Nat. Poiss., vol. 10, 1835, p. ²⁰⁷~~152~~. Sea of the

Indies. — Bleeker, Nat. Tijds. Ned. Indie,

deel 6, 1854, p. (90) 103 (Banda; Neira). —

Bleeker, Neth. Soc. Ind. Neerl., vol. 2, no. 7,
1857, p. 5 (Amboina). — Günther, Cat. Fish.

Brit. Mus., vol. 3, 1861, p. 336 (copied). —

Günther, Journ. Mus. Godeffroy, band (4, - 4),

1875, p. 112, plate 73, fig. A. (Raiatea and

Society Islands). — Pellegrin, Bull.

Soc. Zool. France, tome 39, 1914, p. 227 (Diego

Suarez, Madagascar).

Hepatus lineolatus Fowler, Bishop Mus.

Bull., no. 22, 1925, p. 28 (Honolulu), p. 34

(Samoa). — Fowler and Ball, l.c., no. 26,

1925 (1926), p. 19 (Laysan, French Frigate

Shoals and Johnston Island).

though spinous. Ventrals nearly
symmetrical, with feeble spine
and 5 soft rays.

Side of head striped and spotted
yellowish olive through eye. No white
on tail. Dorsal margin olive, narrowly
black or blue? on edge, with 4 slaty
stripes. Pectoral tip yellow.

5104. Sandakan Bay, Borneo. March 2,
1908. Length 303 mm.

A1550 and A1553. Lan Wan, Formosa.
January 25, 1910. Length 322 to 333 mm.

Genus Psettodes Bennett

1943

Psettodes Bennett, Proc. Zool. Soc. London, vol. 7, p. 147, 1831. (Type Pleuronectes belcheri Bennett, monotypic.)

Sphagomorus Cope, Trans. Amer. Philos. Soc., vol. 13, p. 407, 1866 (1869). (Type Pleuronectes erumei Schneider, monotypic.)

Body ovoid. Caudal peduncle distinct. Mouth very wide. Maxillary more than $\frac{1}{2}$ head, extends far back. Each jaw with 2 rows of long, slender, curved, distant teeth, front ones of inner lower row longest and received in groove before vomer. Gill membranes scarcely united at throat. No gill rakers or only as clusters of minute spines. Scales ciliated. Dorsal and anal scaleless, depressible in scaly basal sheaths.

Caudal finely scaled. Dorsal begins at nape of neck, most rays like those of anal, branched.

Apparently two species.

Psettodes belcheri Bennett from West Africa is said to represent a distinct species with smaller scales. These are the most generalized of the flat fishes, with certain percoid characters suggesting ancestry from the primitive percoid stock.

A 1475. Cape Kart, Libani Bay, Celebes.

December 29, 1909. Length 525 mm.

Slaty brown, with darker lines, upon fading side of head and body with scattered bluish spots little larger than nostril. Yellow wash through eye bright, more or less yellow downward on frontal snout ridge and paler wash over side of head back to pectoral.

Dorsal and anal stripes pale slaty. Caudal spine with yellowish socket. Pectoral bright yellow.

8859 and 8860. Raet Point. June 15, 1909.

Length 370 to 395 mm.

A 888 and A 886. Limbe Strait, Celebes.

November 10, 1909. Length 300 to 508 mm.

Slaty stripes on lavender olive ground color.

Psettodes erumei (Schneider)

1945

Pleuronectes erumei Schneider, Syst.
Ichth. Bloch, p. 150, 1801 (type
locality: Tranquebar).

Hippoglossus erumei Cuvier, Règne
Animal, ed. 2, vol. 2, p. 569, 1829
(— Rüppell, Neue
Wirbelth., Fische, p. 84, 1835 (reference).
— Cantor, Journ. Asiatic Soc. Bengal,
vol. 18, pt. 1, pp. 1198, 1200, 1849 (1850)
(Pinang Sea; Malay Peninsula).

(Rüppell, Atlas Reis. nördl. Afrika,
Fische, p. 121, 1828 (Massana)). —

Psettodes erumei Günther, Cat. Fishes
Brit. Mus., vol. 4, p. 402, 1862
(Singapore, China, Pinang, Japan,
India); Fishes of Zanzibar, p. 112,
1866 (Zanzibar). — Kner, Reise
Novara, Fische, p. 282, 1865 (Java;
Madras). — Bleeker, Atlas Ichth.
Ind. Néerl., vol. 6, p. 4, pl. (1) 232,

- fig. 7, 1866-72 (Java, Madura, Sumatra, Pinang, Singapore, Bintang, Banca, Ambona). — Klunzinger, Verh. zool. bot. Gesell. Wien, vol. 21, p. 570, 1871 (Red Sea). — Day, Fishes of India, pt. 3, p. 422, pl. 91, fig. 4, 1877; Fauna British India, Fishes, vol. 2, p. 439, fig. 155, 1889.
- Alcock, Journ. Asiatic Soc. Bengal, vol. 58, pt. 2, no. 3, p. 280, 1889 (Fake Point to Ganjam, 10 to 23 fathoms).
- Regan, Journ. Bombay Nat. Hist. Soc., vol. 16, p. 330, 1905 (Persian Gulf).
- Jordan and Seale, Bull. Bur. Fisher., vol. 26, p. 45, 1906 (1907) (Cavite). —
- Evermann and Seale, Bull. Bur. Fisher., vol. 26, p. 106, 1906 (1907) (San Fabian). — Jenkins, Mem. Indian Mus., vol. 3, p. 23, 1910 ().
- Bean and Weed, Proc. U.S. Nat. Mus., vol. 42, p. 610, 1912 (Batavia).

1947

— Barnard, Ann. South African
Mus., vol. 21, pt. 1, p. 383, pl. 17, fig.
1 (copied), June 1925 (Delagoa Bay).
— Horman, Biol. Res. Endeavour,
vol. 5, p. 221, 1926

Rec. Indian Mus., vol. 29, pt. 1, p. 8,
text fig. 1, April 1927 (Santapali,
Gopalpur, Madras, Orissa, Hughli
River mouth, Akayab, Elephant Point,
Mergui, Andamans; Persian Gulf;
Muscat; Gulf of Oman). — Weber
and Beaufort, Fishes Indo Austral.
Archip., vol. 5, p. 97, fig. 24, 1929
(Tuban and Besuki, Java; Java
Sea; Madura; Makassar, Celebes;
Flores). — Fowler, Proc. Acad. Nat.
Sci. Philadelphia, vol. 81, p. 615, 1929
(Hong Kong). — Tirant, Serv. Océan.
Pêch. Indo Chine, 6^e note, p. 172, 1929
(Phu Yen).

Pleuronectes nalaka Cuvier, ¹⁹⁴⁸ Règne
Animal, ed. 2, vol. 2, p. 340, 1829
(on hooree nalaka Russell, Fishes
of Coromandel, vol. 1, p. 60, pl. 77,
1803; type locality: Vizagapatam).

Hippoglossus dentex Richardson, Zool.
Voy. Sulphur, Fishes, p. 102, pl. 47,
1843-45 (type locality: southern
coast of China); Ichth. China Japan,
p. 278, 1846 (China; Canton).

Hippoglossus orthorhynchus Richardson,
Ichth. China Japan, p. 278, 1846
(type locality: coasts of China; Canton).

Hippoglossus goniographicus Richardson,
Ichth. China Japan, p. 279, 1846
(type locality: coasts of China; Canton).

Bleeker, Nederl. Tijds. Dierk., vol.
4, p. 130, 1873 (reference). —
(1874)

Psettodes goniographicus Che, Biol.
Bull. St. John's Univ., Shanghai, no.
1, p. 89, Jan. 1931 (compiled).

1949

Hippoglossus quadrifasciatus van
Hasselt, in Bleeker, Atlas Ichth.
Ind. Néerl., vol. 6, p. 5, 1866-72.
(type locality: Java; name in
synonymy).

Depth $2\frac{1}{6}$ to $2\frac{1}{4}$; head $3\frac{1}{10}$ to $3\frac{1}{4}$,
width $2\frac{2}{3}$ to 3. Snout to lower eye
 $3\frac{2}{3}$ to $3\frac{4}{5}$ in head from snout tip;
lower orbit $6\frac{1}{2}$ to 7, $1\frac{3}{4}$ to $1\frac{4}{5}$ in
snout, exceeds entire interorbital
width; eye small, about $\frac{1}{3}$ to $\frac{2}{5}$ of
orbit; maxillary extends beyond eye
greater than length of orbit, expansion
1 to $1\frac{1}{5}$ in orbit, length $1\frac{1}{3}$ to $1\frac{2}{5}$ in
head from snout tip; bony interorbital
less than pupil. Gill rakers 6 + 9
very low broad spinescent tubercles,
barely $\frac{1}{4}$ of gill filaments, which
subequal with orbit.

Scales 58 to 60 in lateral line
to caudal base and 5 to 7 more on
latter; 22 to 24 above, 33 to 38 below.
Maxillary of colored side with 2 or 3
rows of small scales terminally,

1950

naked on blind side. muzzle,
snout and interorbital naked.
Scales with 24 to 31 basal
radiating striae; 14 to 20
radiating apical striae ending
in as many weak points; circuli
fine, last distinct or regular
apically.

D. 50 to 53, fin height $2\frac{3}{5}$ to
3 in total head length; A. 37 to
43, fin height $2\frac{2}{5}$ to $2\frac{1}{2}$; caudal
 $1\frac{1}{8}$ to $1\frac{1}{4}$, double convex or
broadly emarginate behind; least
depth of caudal peduncle $2\frac{1}{8}$ to
 $2\frac{1}{2}$; pectoral 2 to $2\frac{1}{3}$; ^{left} ventral
 $2\frac{1}{2}$ to $2\frac{2}{3}$.

7171. West coast of Palau Island.

November 18, 1905. Length 392 mm.

Very dark olive, paler below, with smoky purplish shades. Brassy before eye, on maxillary and terminal third of pectoral. In facing each scale apparently with bronze mark.

Somewhat obscure stripes, below slate and undulating. Dorsal very dark brownish orange, becomes brassy in facing, more or less crossed by 4 or 5 dark nearly circular spots of pupil. Anal like dorsal. Caudal fins purplish, without bars. Paired fins with brassy shades.

Colored side (right or left)
uniform umber, uncolored
side whitish. In young sometimes
3 paler or grayish transverse
bands on body and another at
caudal base, often pale basal
caudal band persistent with age.
Iris dark neutral gray. Dorsal
and anal usually little darker
than body color, or more dusky
and narrowly edged paler.
On blind side vertical fins all
dusky terminally.

Arabia, Persian Gulf, Portuguese
East Africa, Zanzibar, India,
Malaya, East Indies, Philippines,
Indo China, China.

width. Anal like dorsal, with hyaline
at base very indistinct, very similar
to body color; plumbeous base ¹².
Caudal dusky indian purple. Pectoral
yellowish olive, shades bright lemon
yellow on terminal third, extreme edge
hyaline. Ventral membranes yellowish,
rays with purplish shades.

A 653. Simaluc, Sibi Sibi Island.
September 23, 1909. Length 348 mm.

A 834 and A 854. Jalise Island.
November 9, 1909. Length 215 to 350 mm.

A 1404 and A 1405. Tamojana Island.
December 21, 1909. Length 245 to 265 mm.

A 573. Tutu Bay, southern Jolo. September
19, 1909. Length 378 mm.

¹⁹³²
4208, ✓ Corregidor Light, S. 89° W.,
D. 5361.

7.2 miles (lat. 14° 24' 15" N., long.
120° 41' 30" E.), Manila Bay.

In 12 fathoms. February 8, 1909.
Length 153₁ mm. ^{to 263. Smaller dextral, larger sinistral.} ~~153 mm.~~

19408. Iloilo market. March
28, 1908. Length 128 mm. Dextral.

Two examples. Manila market.
December 12, 1907. Length 133 to
148 mm. Larger dextral, smaller
sinistral.

8051. Manila market. March 18,
1908. Length 127₁^{mm.} Dextral.

20094. Manila market. July
11, 1908. Length 138 mm. Sinistral.

covered with indistinct plumbeous
vermiculations. yellowish stripe through
eye, yellowish following line of gill
opening. About breast and pectoral
axil. Iris brown with golden lines on
edges. Teeth brownish. Caudal spine
dusky on under side, top of spine
black, keel colorless, socket greenish.
Dorsal yellowish olive, crossed by oblique
plumbeous bars, $\frac{2}{3}$ pupil width
from in front upward; upper begins
at first spine base, rises to near tip of
fourth, continued parallel to edge of
vertical of fin; above ground color
more orange, narrowly margined black;
other bars 6; fin base bluish plumbeous,
forming narrow stripe about half pupil

17605, 17606. Manila market.

July 29, 1908. Length 200 to 215 mm.

Larger sinistral, smaller dextral.

6730. Manila market.

December 5, 1908. Length 272 mm.

Sinistral.

8562 to 8568. D. 5442. San
Fernando Point Light, N. 39° E.,
8.4 miles (lat. $16^{\circ}30'36''$ N., long.
 $120^{\circ}11'06''$ E.), ~~Cuyo~~ west
coast of Luzon. In 45 fathoms.
May 10, 1909. Length 244 to 418
mm. Two dextral, others
sinistral.

motting; head and body anteriorly with more or less yellowish wash, becomes distinct as sort of stripe through eye. Dorsal and anal broadly streaked with body color, afterward fading to yellowish and slaty purplish. Caudal like body. Pectorals yellowish, hyaline terminally. Ventrals tinged yellowish.

7113 and 7114. Port Van Pi's Quinto, Camaguion Island. November 12, 1908. Length 245 to 260 mm.

4887. Viasi Island, from fishermen. February 16, 1908. Length 354 mm. Forehead and front part of back dark olive, posteriorly from about middle of dorsal and obliquely toward ventral base

7856. D. 5358. Sandakan¹⁹⁵⁴
Light, S. 34° W., 19.7 miles (lat.
 $6^{\circ} 6' 40''$ N., long. $118^{\circ} 18' 15''$ E.),

Jolo Sea: In 39 fathoms.
January 7, 1908. Length 265
~~fath~~ mm. dextral.